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EM-453 (A. Rampertaap, 3-8191)

Rocky Flats/Albuquerque Production Division Comments on Draft Phase III RCRA Facility Investigation/Remedial Investigation Report for Operable Unit 1 (881 Hillside)

Frazer Lockhart, RF

The Office of Southwestern Area Programs, Rocky Flats/Albuquerque Production Division (EM-453), has reviewed the above-referenced document and is providing the attached comments. Please address these comments before the document is finalized.

Generally, we are concerned that the document is not yet complete. In the past, the Environmental Protection Agency and the Colorado Department of Health have reacted strongly when presented with milestone documents that are not complete. In the case of this document, surficial soils and groundwater geochemical data have not yet been included, therefore a complete review was not possible. Also, all of the presented data has not yet been validated.

Call me at FTS 301-903-8191 if you have any questions related to this request.

Autar Rampertaap
Rocky Flats/Albuquerque Production Division
Office of Southwestern Area Programs
Environmental Restoration

Attachment
cc w/o attachment:
R. Greenberg, EM-453
J. Hartman, RF
B. Magee, HAZWRAP
J. Ciocco, EM-453

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United States Government **Department of Energy**

memorandum

DATE: JUL 17 1992

REPLY TO ATTN OF: EM-453 (A. Rampertaap, 3-8191)

SUBJECT: Rocky Flats/Albuquerque Production Division Comments on Draft Phase III RCRA Facility Investigation/Remedial Investigation Report for Operable Unit 1 (881 Hillside)

TO:

Frazer Lockhart, RF

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Claire Greenberg

Autar Rampertaap
Rocky Flats/Albuquerque Production Division
Office of Southwestern Area Programs
Environmental Restoration

Attachment
cc w/o attachment:
R. Greenberg, EM-453
J. Hartman, RF
B. Magee, HAZWRAP
J. Ciocco, EM-453

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EM-453 COMMENTS ON: DRAFT, PHASE III RFI/RI REPORT,
ROCKY FLATS PLANT, 881 HILLSIDE OPERABLE UNIT NO. 1
VOLUME I AND VOLUMES 2

GENERAL COMMENTS:

I. The document is not yet complete. Surficial soils and groundwater geochemical data in particular have not yet been included, therefore a complete review was not possible. Also, all of the presented data has not yet been validated.

II. The discussion on background for soils, and probably for groundwater, needs to be expanded. A table (Table 4-1) is provided that has specific background values, however the text discussion seems to include a higher range than the values on the table, i.e., multiples of these values are used. This area needs clarification as to what "background" is considered to be at the Rocky Flats Plant.

III. Almost every section included a statement that several organic species were "probable" laboratory contaminants. Perhaps a section devoted to providing laboratory Quality Assurance (QA) /Quality Control (QC) Data would clarify the situation and set an upper limit for what is considered laboratory contamination. If this is a widespread problem as this report indicates then corrective measures should be implemented on the operable unit (OU) investigations.

IV. The discussion on seeps needs to be consolidated into one section or subsection. This is one of the most important pathways for contamination to be transported into surface water drainages. The present discussion is scattered throughout the text and not supported with documented evidence, i.e., seeps are not specifically identified by location, or by a set criteria.

V. The data on aquifer characteristics is not comparable. The discussion in that section is confused, with various numbers being presented and then refuted. Currently that section reads like the data collected does not match what was expected, and so the data was discarded. Perhaps only the data which has the reliance should be presented in the text, with the remainder presented in an appendix with a discussion as to why the data is not considered valid.

VI. The discussion on Applicable or Relevant and Appropriate Requirements (ARARs) does not appear consistent with EPA guidance. At this stage the ARARs should be evaluated with regards to Applicability, Relevance, and Appropriateness and presented as such, not left as "potential." Also, the Record-of-Decision (ROD) is not used for determining ARARs but to document what ARARs can be met, and which ARARs require a variance.

SPECIFIC COMMENTS

1. Executive Summary, p. xxiii, first paragraph: According to an earlier statement, there is no surficial soils data. Please clarify where the information on Uranium, and Plutonium in surface soils is located.

2. Section 1.2.3, p. 1-14, second paragraph, last sentence: As this report is dated June 1992, the reference to a report "expected to be complete in May 1992" is probably incorrect. Please clarify.

3. Section 1.3.2, p. 1-20, second paragraph: It does not appear that EPAs concern on ARARs has been met. The concern expressed dealt with a determination on which ARARs would be used at this site. From the text it appears that all ARARs are still considered potential. Please clarify.

4. Section 3.4, p. 3-5, second paragraph: The statement that includes Dry Creek in draining the northern portion of the plant security area is incorrect. Dry Creek drains the northeastern part of the buffer zone. An unnamed tributary of Walnut Creek drains the northern area of plant security area. Also Rock Creek should be mentioned draining part of the Rocky Flats Plant.

5. Section 3.4, p. 3-6, first paragraph: Please provide evidence regarding the gaining and losing relationship of the South Interceptor Ditch (SID) in the OU-1 area. Table 3-2 would suggest the SID losses water along its entire reach in this area.

6. Section 3.6, p. 3-8, second paragraph, last sentence: This statement could be deleted. Section 3.6.2, appears to an adequate coverage of the items listed as not being covered in this report.

7. Section 3.6.2, p. 3-14, first paragraph, third sentence: This statement is rather broad and not yet supported by information in the text. Recommend either deleting statement or providing the supporting information immediately following this paragraph.

8. Section 3.6.2, p. 3-15, first paragraph: Please verify the statement of the Arapahoe Formation not being present at OU-1. The mapping report of March 1992 had Arapahoe Formation in one part of the OU-1 area.

9. Section 3.6.3, p. 3-20, second paragraph: This discussion on seeps seems out-of-place. This discussion would seem to be better placed in Section 3.7, "Hydrogeology."

10. Section 3.7, p. 3-21, second paragraph: This discussion is important to understanding the Hydrogeological regime at OU-1, and Rocky Flats Plant, however it is difficult to follow. Recommend the use of a schematic figure to illustrate what is being discussed and perhaps breaking this paragraph into three paragraphs, one discussing

aquifers, one the upper hydrostratigraphic unit, and one on the lower hydrostratigraphic unit.

11. Section 3.7.1, p. 3-26, second paragraph: Please clarify the relationship of seeps and groundwater. It would seem that seeps are the result of the groundwater surface intersecting topography which would not make the seep a "source" of groundwater. Perhaps reference should be made to the seeps as contributing water to surface drainages instead of as a "source" of groundwater.

12. Section 3.7.1, p. 3-28, fourth paragraph: No data, is provided or no flow shown on Table 3-2 for station SW-46. This would indicate that this may not be a "seep."

13. Section 3.7.2, p. 3-33, third paragraph: The last sentence on this page needs further clarification. The Standard Operating Procedures (SOPs) were designed to keep the problem of data incomparability from occurring. The data that cannot be used should not be presented, or more detailed explanation as to the different methods employed provided. Perhaps the data with no confidence can be provided in an Appendix.

14. Table 3-2: Please provide a cross reference to a figure showing sampling locations. (Applies to all tables with sampling data).

15. Figure 3-7: The hinge line shown running through Rocky Flats Plant is not supported by cross-sections. Please clarify what this hinge line represents.

16. Figure 3-11: This surface geology map does not agree with the surface map in the March 1992 Surface Mapping report. The 1992 map had more bedrock shown and also placed Arapahoe rock at the surface. Please clarify.

17. Section 4.0, p. 4-2, second paragraph, last sentence: Please define "locally analyzed."

18. Section 4.0, p. 4-2, third paragraph: Please clarify what "locations not sampled at the time of this report" means. Will these locations be sampled and included in the final report.

19. Section 4.0, p. 4-5, second paragraph: The handling of background needs clarification. Does Table 4-1 represent values of background or does a multiplier of the values on this table represent background?

20. Section 4.1, p. 4-6, third paragraph: Please include a discussion on the ratios of various isotopes to differentiate man-made from naturally occurring material, if ratios were or can be determined.

21. Section 4.1, p. 4-7, first paragraph: ARARs should be presented in the Remedial Investigation (RI)/Feasibility Study (FS) RI/FS, not "determined" in the ROD. The ROD, through the FS, can document a

variance from an ARAR, not determine ARARs.

22. Section 4.2, p. 4-9, second paragraph: This table needs more explanation in the text, or with the table itself. Currently it means nothing and could be deleted as the information contained in the table is not used.

23. Section 4.2.1, p. 4-10, second paragraph: The statement on detections of organics being related to lab contamination needs to supported. As this appears to be a general problem throughout the investigation a section prior to the Individual Hazardous Substance Sites (IHSSs) specific discussions presenting the QA/QC data would be useful. (Applies to all sections on IHSS investigations.)

24. Section 4.2.2, p. 4-12, fifth paragraph: Please relate the values found for these metals to the background values provided in table 4-1. Also utilizing the mean of samples at each IHSS as a determinant does not appear correct. If background was determined by analyzing a statistical significant data set, then individual sample values should be compared against that background, not local populations. Please clarify what purpose evaluating IHSS specific population means to background accomplish. (Apply to all sections on IHSS investigations).

EM-453 COMMENTS ON: DRAFT, PHASE III RFI/RI REPORT,
ROCKY FLATS PLANT, 881 HILLSIDE AREA OPERABLE UNIT NO. 1
APPENDICES

APPENDIX E - ENVIRONMENTAL EVALUATION

GENERAL COMMENTS:

1. The RFI/RI report (vols. I and II) is written in a style that implies less uncertainty than is evident from a review of the appendices. The concerns raised in this appendix would not be apparent from reading the first two volumes of this report.

2. The overall process as it relates to decision-making is not clear. It is recommended that text be added to clarify how the results of the Environmental Evaluation (EE) will be used.

3. It appears that the EE is in need of a decision matrix (or tree) which defines when no further action is necessary. The ten task approach appears to be a template strategy that must be completed in its entirety before the EE can reach a conclusion. As it is currently configured and implemented, the EE approach may not have the flexibility to take advantage of opportunities for early conclusion.

   The OU1 RFI/RI investigation should be used as a tool to indicate where the EE approach can be streamlined and improved. It is not apparent from the previous OU work plans that potential improvements in the EE strategy can be incorporated into later investigations. One issue that should be apparent from the OU1 EE is the need to verify that the EE process can be justifiably terminated without completing all of the ten steps. In an attempt to address this issue, it is requested that a copy of the Scope of Work to the subcontractors be made available for review.

4. The RFI/RI report would benefit from a consolidation of the text information into a few tables and graphs. As in the OU1 work plan, the EE process relies on prose instead of clear graphical presentations. The entire process is confusing and seems to wander from point to point without identifying a critical path. The text would greatly benefit from graphical depictions of the strategy being employed to define the EE approach.

5. The first seventy four pages of E.2.0 Site Description read like a field guide to the biota of Rocky Flats. While this information may be necessary for the EE, it should not dominate the report. The descriptive material should be placed at the end of this appendix or briefly presented in tabular form. Physio-chemical and biological evaluations could also be represented in tables. There is a distinct

need to reduce this information and provide a means of rapidly compare the results of the field activities.

6. After reviewing the EE process, it is not clear why selection of contaminants of concern (COCs) was considered necessary when the field surveys indicated that contamination was not a problem at OU1.

   In light of the entire process, it appears more desirable to first select COCs and complete the exposure and toxicity assessments for a risk characterization which subsequently would direct the field investigations. Using the risk characterization would provide a more direct and selective approach to identifying targets for further analysis. It is recommended that specific criteria be delineated which would describe conditions under which field surveys would be undertaken and those which would not call for further investigation.

7. It is recommended that a more prominent table of the toxic reference values (TRVs) and final reference values (FRVs) including those that will be used for organisms higher on the food chain be included in this document. The literature cited supporting the use of various correction factors to be applied to the toxicological value was not available for review. Typically, however, a correction factor of 10 is applied for each area of uncertainty. Additionally, the document should present the equations used for derivation of TRVs for arsenic, cadmium, and copper (it is said they are based on biomagnification potential) and the exposure factors used (e.g. bioaccumulation factors for species considered etc.). Where TRVs are based on toxicological literature, the reference should be included in Table E.5.3.1-1.

8. The major conclusion from the EE of OU1 indicates that contamination from the identified sources probably does not have an adverse effect on the biota. The EE does not provide a description conditions necessary to confirm an adverse effect within the biological community at OU1. With such a result, it is not clear if the EE methodology could have detected the presence of an adverse effect.

9. The TRVs are said to be set based on bioaccumulation but the equations used to derive these concentrations are not presented. It is recommended the equation appear in the text or in an appendix. All factors used to derive these values should also be presented in the document.

10. It is recommended that the derivation of a benchmark protective of communities be reported in the document. No Adverse Effect Levels (NOAELs) and Lowest Adverse Effect Levels (LOAELs) are based on the responses of individuals so any corrections applied to represent protection at the population/community level should be shown either in the text or in an appendix.

11. It is recommended that the authors reframe from using the term, significant, in the RFI/RI report unless it refers to a specific statistical analysis where the level of significance is clearly defined.

GENERAL COMMENTS:

Public Health Evaluation

12. The risk assessment was carried out on data from samples gathered in Phases I and II. Accordingly, what is lacking from this synthesis is a clear-cut description of how well or badly the different phases of the study can be integrated, and how the data quality objectives (DQOs) from the different phases of the study may compare with each other.

    In general, the identification of the ground water samples with a 1990 and 1991 sampling collection effort, although the soil samples date back to 1987, does not give grounds for confidence that the accumulated data will form a coherent basis for the establishment of discrete remediation goals or to allow an adequate testing of the no action alternative. The collection effort was biased towards the Individual Hazardous Substance Sites (IHSSs) again fails to give reassurance that the body of data will serve to provide an adequate basis for a scientifically-based decision on the extent to which the pollutants at the site may constitute a viable hazard to human health.

13. Tables 1 and 2 of Appendix F-6 give a well thought out demonstration of how various bodies of carcinogenic and non carcinogenic risk data may be pooled. This has be done, for non-carcinogenic endpoints, according to target organ, or, for carcinogenic endpoints, according to the weight-of-evidence classification. A large amount of raw data has been summarized in a readily assimilable form.

    A step by step demonstration of how these risk values were derived is needed. Such a demonstration could perhaps best be achieved by using a tabular format. The derivation should include more than merely the product of an intake concentration with either the slope factor or the reciprocal of the Reference Dose (RfD). What are required are specific derivations of the intake concentrations for the exposure scenarios, using clearly defined input values, whether the arithmetic mean, geometric mean, or 95% Upper Confidence Limits (UCL) etc., factored with specified verifiable physiological estimate parameters.

    The application of quantitative uncertainty analysis to the conversion of field data to an approximation of dose concentration, and how such intake values might then be used to calculate risk, should be much more clearly described. Larger figures in Section 5, with much more descriptive annotation would be a useful additional component of this clarification process. The use of the results of the uncertainty

analysis in the further determination of intake concentration is another important requirement. Every effort should be pursued to give assurance that the mathematical approach is sound by providing enough data and guidance to allow readers to follow the transformations from field data to computed risk. The present compendium of field data, descriptive statistics, estimate parameters, and risk estimates contained variously in Tables 2-3 through 2-6, Table 3-11, Tables 5-2 and 5-4, and Tables 6-1 and 6-2, do not allow an informed reader to manipulated the data and readily confirm the reported risk values.

14. The rationale for the exclusion of potentially important exposure scenarios and pathways should be discussed in detail. Reference to Tables 1 and 2 of Appendix F-6 makes clear that no risk determinations have been carried out based on the ingestion of ground water or home-grown vegetables under the future on-site residential exposure scenario, whereas home-grown vegetables are considered under the current off-site scenario. Although agricultural land uses are prominent in the vicinity of the Rocky Flats Plant (RFP), no agricultural exposure scenarios are evaluated for future conditions.

15. Methodologies used to derive exposure concentration should be revised. Although the methodology used to derive exposure concentrations for soils is not clearly defined, apparently, subsurface soil samples were used to derive the exposure concentrations. The use of subsurface soil data (e.g., soil samples collected at a depth of greater than 1 - 2 feet) in the calculation of human health risks due to ingestion and inhalation exposure routes is inappropriate, especially in view of the potential importance of wind-blown radionuclide contamination.

16. Taking Volume XVII as a stand alone report, the apparent absence of a clear statement of the site-specific objectives of the risk assessment, and of any delineation of adequate Data Quality Objectives (DQOs) using the methodology recently developed by the EPA Quality Assurance Management Staff, cast doubt on whether the plan has conformed to the requirements for remedial investigation scoping as set forth in *Guidance for Conducting Remedial Investigations and Feasibility Studies under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)*, U.S. Environmental Protection Agency (EPA) EPA/540/G-89/004 (1988). Failure to conform with the guidelines for such scoping activities and for the establishment of DQOs and preliminary remediation goals may result in a data collection and analysis effort which does not adequately control uncertainty and does not provide a quantitative basis for scientifically justifiable decision-making.

17. Applicable or Relevant and Appropriate Requirements (ARARs) should be evaluated in addition to risks computed from the actual levels of pollutants in the environmental matrix. In this report Reference Doses (RfDs), Reference Concentrations (RfCs), and slope factors, as derived from EPA's Integrated Risk Information Service (IRIS) and other secondary references have almost exclusively used, as their source of human toxicity reference values. This appears to ignore the

importance of ARARs in limiting concentrations or doses of potential contaminants in various media.

18. Volume XVII of this report should be written to be less repetitive. For example, the same material appears in chapter six of Volume I, often in almost identical language. The same material then reappears in Chapter 7 of Volume XVII, and in Appendices F1 - F6. Again the prose and tables are nearly identical.

19. The pooling of carcinogenic risk according to the weight-of-evidence classification is harder to justify. An equally good case could be made for pooling the cancer risk data according to target organ specificity in a like manner to the non-carcinogenic data. Similarly, one could justify pooling all the cancer risk data into one category.

20. The statement "the impacts calculated under the on-site residential land use scenario are extremely health-conservative; actual exposure, even under plausible future use scenarios, will undoubtedly be much lower" should be thoroughly explained. More detailed justification for this statement should be provided in view of: (1) the large uncertainty surrounding the risk estimates, (2) the fact that Phase III data were not used in the risk calculations, (3) the extremely long-term persistence of radionuclides in the environment, (4) the apparent use of subsurface soil data in the development of soil ingestion and inhalation exposure concentrations, (5) the exclusion of ground water and home-grown vegetable ingestion pathways, and (6) the exclusion of agricultural exposure scenarios.

21. The validity of data obtained from samples that were collected during the Phase III subsurface soil sampling program can be questioned. During this event, subsurface soil samples were composited from 6 feet intervals for all analytes except volatile organic compounds. The resolution capabilities of such a sampling design should be questioned. Composite samples represent an average over a wide depth or area. As such, they can "dilute" high concentrations in any one depth or area within its range. In addition, no measurement of the variance within composites can be obtained and thus no measurement of precision can be made. Composites measure the variability of the parts of the population but not the variability within each part which could be significant particularly if contamination is stratified and the thickness of contamination is less than the sample interval. It is suggested that RFP reevaluate the soil sampling program and recognize the limitations and define the decisions that can be made from results of the samples that were collected.

22. The utility of site-wide background concentrations in addressing unit-specific conditions should be reviewed. It is recognized in Section 4 of this report that for various common rock-forming elements, on-site concentrations exceed site-wide concentrations. However, these constituents are not considered contaminants on the basis that they are common rock-forming elements. It is possible then that additional

on-site constituents may also exceed site-wide background concentrations, but may be present at site background concentrations, and be considered as contaminants on the basis that they are not "common rock-forming elements." We suggest that RFP aggressively embrace the use of site-specific background data (such as that identified for the surficial soil sampling conducted during Phase III) and employ rigorous statistical techniques (defined in the report) by which possible contaminants will be identified.

23. The source of all data used in the baseline risk assessment should be identified. If the data used were generated from different sampling phases, the useability of the data should be carefully examined.

24. To further understand the report certain elements should be clarified. Although RAGS does not require a quantitative uncertainty analysis, a quantitative uncertainty analysis was conducted for the public health evaluation in this RFI/RI report. Sensitivity analysis and uncertainty propagation were applied for some exposure modeling and risk characterization. However, the following issues need clarification or were not addressed in this report:

(1) The number of data points used in determining the probability distribution type (e.g., normal or lognormal distribution) for a particular input parameter was not provided. If data points are not adequate or representative, additional uncertainty may be introduced into the whole assessment.

Furthermore, the description of the distribution determination was not justified. Those situations where normal or lognormal distributions were not observed should be discussed further.

This report indicated that professional judgment was used when insufficient data were available. Data/information combination techniques (e.g., the Bayesian's Approach, fuzzy logic theory, Dempster-Shafer method, or the classical probability theory) should be used when objective (i.e., sampling or monitoring) and subjective (i.e., professional judgments) sources of information are utilized. This should be carefully evaluated. Otherwise, the effects caused by the "uncertainty of uncertainty" may be unacceptable.

(2) It is not clear why the sensitivity analysis was applied on soil-gas modeling and risk calculation only. Why sensitivity analysis is not conducted on other transport models should be explained.

It is not clear how the sensitivity analysis results (Appendix F, Table 5-6) of the final risk calculation were used. The purpose of a sensitivity analysis is to select the most sensitive parameters and determine their probability distributions (use deterministic values for those insensitive parameters). There is no evidence of the use of the analysis to address sensitive parameters.

(3) The input parameters required for running the Monte Carlo trials

of the final risk calculations were not provided. The number of iterations should be determined to generate a representative sampling set. This information should be provided.

25. The cumulative effect of contaminants from different pathways should be addressed. Significant emphasis is placed on the range of risks calculated for single contaminants (i.e., 10^{-6} to 10^{-4}). Although attention is given to the cumulative risks in Appendix F-6, the Executive Summary and text fail to discuss this important aspect of the risk assessment.

26. A detailed description of the risk and uncertainty calculations should be given.

    For the scenario with the greatest calculated risk (1.8×10^{-5}), the report states that the uncertainty is "large." It should be clarified whether this is a relative measurement or absolute measurement.

27. Uncertainty analysis calculations should be provided. Appendix F-7 is referenced for details of the uncertainty analysis. Appendix F-7 contains only a "review checklist".

28. Justification for the risk screening criteria should be given and references for the information should be provided. It is not clear why 10^{-7} (carcinogenic) and 0.1 (non-carcinogenic) were used for risk screening criteria.

29. For some of the site conceptual models shown in this report, no "exposure routes" were indicated (e.g., Appendix F, Figure 3-4). These omissions should be explained or the models revised.

30. The two approaches for estimating overall uncertainty in the risk assessment (i.e., summation of variance and propagated error technique) should be evaluated. Determination to which one should be used and why should be provided.

31. Whether the values of mean and standard deviation provided in Appendix F, Table 5-2 are in normal or lognormal distribution should be clarified.

32. For verifying the calculated intake in each pathway (or route) a list of Contaminants of Concern (COC) concentrations should be given. An independent risk calculation for path #2 (shown in Appendix F, Section 5, Table 5-4) using the exposure assumptions given in Appendix F-4, Table 3, resulted in an Arsenic concentration of 4.9×10^{-6} mg/m^3 which compares closely to the concentration provided in Table 5-4 of 2.3E-6 mg/m^3. However, an example to support these calculations would be helpful.

33. The quality control data presented in Appendix D includes trip and rinsate blanks only. The analysis and use of duplicate and split samples is not provided. The EPA guidance for assessing errors, *A*

Rationale for the Assessment of Errors in the Sampling of Soils, (EPA/600/4-90/013) includes clear definitions of QC samples and their purpose. This guidance should be followed to determine the components of variance associated with the sampling process and natural or spatial variances.

APPENDIX A1 - BOREHOLE DATA

GENERAL COMMENTS:

34. Field Standard Operating Procedures (SOPs) are poorly referenced. It is recommended that references to specific SOPs for each aspect of the field work be given in the first paragraph of this section rather than the general reference .

35. It is unusual for a field program of this magnitude to proceed entirely as planned. Any deviations from approved sampling plans or SOPs should be documented in this section.

36. Well development is not discussed. There should be a reference to an SOP and a brief discussion of methods and criteria in the text. Development logs should be included in an attachment.

37. It is recommended that a brief descriptions of disposal methods for drill cuttings and waste water be included in the field summary.

38. The well construction logs in Attachment A1 appear to be rough field logs. Final logs, that have been edited and checked for completeness, should be included with the report. These logs usually include water levels, spatial coordinates and elevations. (The boring logs are also rough field logs, however, the cover sheet indicates that final logs will be available July 30.)

39. The report would benefit from a paragraph or more on well construction, e.g. required materials, dimensions, and a reference to a specific SOP.

40. No understanding of how well locations or screened intervals were chosen is conveyed either here or in Volume 1. It would be appropriate in Volume 1 to develop and present this information in Volume 1.

41. The text and the boring logs refer to continuous core sampling, the text indicates that all sampling was done using a 2 ft split spoon. Since continuous coring literally means that a coring device was used, it would be preferable to refer to continuous split spoon sampling.

APPENDIX A2 - GEOTECHNICAL DATA

GENERAL COMMENTS:

42. Methods for geotechnical analyses should be specified.

43. It would be proper to detail sampling methods here and discuss sources of error and uncertainty. For example, from the discussion in Appendix A1, it appears a standard split spoon rather than a Shelby tube was used to take these samples. What is the likelihood that this method disturbed the samples and affected measurements, esp. permeability?

APPENDIX A4 - FRENCH DRAIN GEOLOGIC CHARACTERIZATION

GENERAL COMMENTS:

44. The significance of this data to the main report is not explained well. How this data complements the OU1 Phase III RFI/RI data and how it provides a comprehensive geologic/hydrogeologic characterization of OU1 is not clear.

45. A general structure/design of the French Drain would improve the text. The French Drain's depth below ground surface, collection system, etc. are also information that should be presented either in this Appendix or referenced to the report. A brief description would of how this data relates spatially to the OU1 RFI/RI is also recommended.

46. No vertical dimensions or sense of scale are given in the text or figures in the discussion of lithologic units or slump structures. In addition to the detailed cross sections, a scaled sketch and lithologic units encountered would be useful.

47. The attachments, in particular the cross sections, are not included with this appendix.

SPECIFIC COMMENTS:

Volume I, Section 6

1. Section 6.1.2.1, pg. 6-4, para. 1: The OU 1 Work Plan (DOE 1991b) referenced was not available for review. This and subsequent sections were reviewed based upon the assumption that the description of the physical setting provided in Section 3.0 will not change significantly.

2. Section 6.1.2.3, pg. 6-6, para. 1 and Addendum to Technical Memorandum No. 6, pg. 2, Bullets 1 and 3: Values for soil adherence, body surface area, and inhalation rate differ from the values in RAGS, 1989 (EPA/540/1-89/002). Please provide the background information

utilized to arrive at the values listed. Please provide the calculation for dermal absorption factors for metals and volatile organic compounds. Adherence factor units should be changed to mg/cm^2.

3. Section 6.1.2.5, pg. 6-7, para. 1 and Appendix F-3, pg. 2-1, para. 2 and Figure 2-1: The discussion of the modeling parameter of environmental fate should be expanded to include potential degradation products resulting from potential chemical, physical, or biological transformation processes. These potential degradation products may be more or less mobile or toxic than the parent material. These issues should be addressed and incorporated into the exposure assessment. Figure 2-1 Fate column should be revised to account for transformation of potential contaminants of concern.

4. Section 6.1.2.5, pg. 6-7, para. 2 and Appendix F-3, Section 3.2, pg. 3-2, para. 1: Please change the references to soil gas conceptual model to Figure 2-3.

5. Section 6.1.2.5, pg. 6-7, para. 2 and Appendix F-3, Section 3.2.1, pp. 3-8 and 3-9: Discussions of assumptions and limitations of the Johnson model are confusing in two areas: Bullet 7 on page 3-8 and Bullet 1 on page 3-9. Each of these bullet items refer to the Jury model. Please correct these items.

6. Section 6.1.2.5, pg. 6-7, para. 2 and Appendix F-3, Section 3.2.2, pg. 3-12, Table 3-1: The soil adsorption coefficient (Kd) is a unitless value. Please correct this item.

7. Section 6.1.2.5, pg. 6-8, para. 1 and Appendix F-3, Section 3.3.2, pg. 3-15: Section 6.1.2.5 is confusing. The last sentence states that ground water transport was not simulated, but in Appendix F-3 a model description and data summary are provided for ground water modeling. The impression is that the french drain will collect shallow ground water and preclude the need for ground water transport modeling. Please revisit this paragraph. Consideration should be given to the volatility of potential contaminants of concern from water in the french drain as a potential route of exposure to on-site and off-site receptors.

8. Section 6.1.2.5, pg. 6-8, para. 1 and Appendix F-3, Section 3.3.2, pg. 3-17, Table 3-2: The adsorption coefficient (Kd) is a unitless value. Please correct this item.

9. Section 6.1.2.5, pg. 6-8, para. 2 and Appendix F-3, Section 3.4, pg. 3-18, para. 1: These sections reference a probable source of contamination of the South Interceptor Ditch as surface runoff from the 903 Pad Area. Please define how contaminants of concern in the surface water runoff from OU 1 will be quantified independently from surface runoff from the 903 Pad Area.

Volume XVII, Appendix F

SPECIFIC COMMENTS:

10. Table of Contents, whole section: A number of sections are ascribed to the wrong page number in the Table of Contents. This is most evident in Chapters 5, 6, and 7. In addition, Sections 5.4, Uncertainty Error Propagation, and 5.5, Summary of Uncertainty Analysis are omitted. These errors should be corrected.

11. Executive Summary, pg. i, para. 2: The discussion of DQOs should be reviewed. The reference to DQOs in this paragraph appears to use the concept of data quality objectives in the wrong context. DQOs are rigorous criteria that establish the type and quality of data required to support decisions regarding remedial response activities. The various phases of the DQO process are an integral part of RI/FS scoping, and as such should have played a major role in the design of sampling protocols, thereby allowing the generation of data with a predetermined level of statistical power and level of uncertainty. The use of DQOs in this paragraph appears to have more relation to the context of analytical sensitivity. The authors should endeavor to show that the extent of their sampling and analytical effort was adequate to delineate the potential hazard to human health posed by the occurrence of pollutants at the site with predetermined and acceptable levels of probability and uncertainty.

12. Executive Summary, pg. i, para. 2: The ready acknowledgement that the risk assessment is based on Phase I and II data only raises the question as to whether this risk assessment is likely to meet Phase III DQOs. More details should be given about how the sampling and analytical effort in Phase III differs from and extends the effort carried out in Phases I and II.

13. Section 1.2, pg. 1-3, para. 1: Accounts of historic activities and a summary of known disposals of pollutants at the various IHSS's are an important descriptive element of the conceptual site model. Accordingly, this section should contain either a brief account of these features or give a reference to the material contained in Section 1.2.2 of Volume I.

14. Section 1.5, pg. 1-4, para. 3: The second sentence should read "...information <u>are</u> located..."

15. Section 2.1, pg. 2-1, para. 2: This report needs to address the delay in analysis and receipt of results from the analytical laboratory for the Phase III samples. A key issue which should be established is the integrity of the analytical protocols regarding holding times.

16. Section 2.1, pg. 2-1, para. 3: The question is raised as to whether it is valid to include such temporally separated material in the same risk assessment. The risk assessment contained in Volume XVII appears to be based on groundwater data obtained from samples collected in 1990 and 1991, and on soil samples collected in 1987. Comments on the

considerable period of time which had elapsed between these two collection efforts should be made.

17. Section 2.1, pg. 2-1, para. 4: The comment that both collection programs were biased towards identifying and monitoring the most contaminated areas at OU1 should be explained. It should be explained to what extent efforts were concentrated on samples from within or near the IHSSs, and make a formal expression of what the DQOs were.

18. Section 2.1, pg. 2-2, para. 3: The section on data validation qualifiers should be restructured. In some cases there is too much detail and in others not enough. For example, there is no mention of what criteria would require data to be rejected, and perhaps more importantly, it is never made clear whether the number associated with the Undetected (U) designation is the sample detection limit (i.e., ug/kg of soil).

19. Section 2.2, whole section: The section dealing with the delineation of the chemicals of concern has been very clearly expressed.

20. Section 2.2.4, pg. 2-6, para. 1: The whole question of the choice of site and the sampling regimens for the collection of background data is not really addressed in this document. It should be state when and where they collected their background samples.

21. Section 2.2.4, pg. 2-6, para. 2: It should explain why the determinant of statistical significance is 0.9.

22. Section 2.2.5, pg. 2-7, para. 2: The Eisenbud reference should be included in the reference list.

23. Section 2.2.5.2, pg. 2-7, para. 1: The value 1×10^{-6} is the incremental or excess individual lifetime cancer risk. This should be stated in the text.

24. Section 2.2.6, pg. 2-8, para. 1: It should be made clear that the metal and radionuclide contaminants persist because of their insolubility, probably either as the oxide or sulfide, or by absorption to soil particles.The fourth sentence reads as if the contaminants persist in the environment because of their long half-lives.

25. Section 2.3, pg. 2-12, Table 2-3: The correct units for americium and plutonium, which are probably pCi/L should be specified.

    The concentrations of methylene chloride and tetrachloroethylene in ground water should be included in Table 2-3.

26. Section 2.3., pg. 2-14, Table 2-5: The whole question of the true meaning of the qualifier U, raised earlier, is brought into focus in this table. The value 30U for antimony implies that 30 ug/L is the sample detection limit for this element. However, in Table 2-3, the

evaluation concentration for this element is 17.2 without the qualifier. Please clarify this discrepancy.

27. Section 2.3, pp. 2-12 to 2-15, Tables 2-3 to 2-6: The choice of arithmetic mean, geometric mean, or median as the parameter to describe the central tendency should be justified.

28. Section 3.0, pg. 3-1, para. 1: The second bullet should also mention the transport of contaminants.

29. Section 3.2.1, pg. 3-10, Table 3-1 : The title "Vicinity of the Rocky Flats Plant" should be changed to "Vicinity of the Predominant Downwind Direction from the Rocky Flats Plant."

    Change for the year 2010, Sector Column D, Segment Column 4, the projected population number "0" to "14"; Sector Column Sum, Segment Column 4, the projected population number "1846" to "1860"; Sector Column D, Segment Column Sum, the projected population number "25" to "39"; and the Sector Column Sum, Segment Column Sum, the projected population number "21,694" to "21,708".

30. Section 3.2.1, pg. 3-11, para. 1: Change the number "8,172 to 21,670" in the second bullet to "8,196 to 21,708".

31. Section 3.4, pg. 3-16, Table 3-2: Please change the titles "Off-Site Resident" and "On-Site Commercial/Industrial Workers" to "Current Off-Site Resident" and "Current On-Site Commercial/Industrial Workers" respectively under the first vertical column heading "Potentially Exposed Population."

32. Section 3.5.1, pg. 3-15, para. 1: Soil should be included as one of the major components of the site model.

33. Section 3.5.1, pg. 3-16 et seq, Tables 3-2 and 3-3: These tables should be reconfigured to clearly delineate the five major features of complete exposure pathways as they may operate in the different exposure scenarios which were chosen. For example, the five key features of complete exposure pathways could be presented in a table as separate headings.

34. Section 3.5.1, pg. 3-23, para. 3: The reference to the absence of leaks and spills at site OU1 appears to contradict some aspects of site history, and the account of pollution events which are described in Section 1.2.2 of Volume I. The whole thrust of that section is to provide an account of how each IHSS came to be contaminated. An attempt to resolve this apparent discrepancy should be made..

35. Section 3.5.1.2, pg. 3-25, para. 4: The reference to "Portions of the SID and Woman Creek within OU1" is confusing, because from the various site diagrams and figures these water courses do not appear to be within OU1 at any point. An attempt to provide more informative figures which explain the relationship of these streams to OU1 should

be made, or this sentence should be changed.

36. Section 3.5.2.1, pg. 3-29, entire section: The whole section devoted to the geology of Green Mountain is not really essential to the major point of this section which appears to be that the 881 Hillside may be an unsuitable area for building.

37. Section 3.5.2.1.1, pg. 3-33, para. 1: Following the sentence that begins with, "However, a preliminary review" is confusing and probably not in place here. It has two possible meanings. First, it could mean that the concentrations in ground water are greater than those in soil. Second, it could mean that, taking the site matrices as a whole and quantifying the contaminants, there was a greater amount of contamination in the total ground water than in the total soil. (The sentence should probably be omitted.)

38. Section 3.5.2.1.1, pg. 3-33, para. 2: For greater understanding, a figure should be in place to illustrate this equation.

39. Section 3.6, pg. 3-58, Table 3-11: The on-site concentrations of the pollutants in the soil appear to represent the 95% upper confidence limit of the evaluation concentrations of the different constituents. It should be explained why these concentrations are the not the critical exposure inputs for the calculation of intake, and consequently why these numbers are not included where appropriate, such as in Table 5-4.

40. Section 4.1, pg. 4-1, para. 1: The expression "...EPA principal approach and rationale..." is needlessly ornate, could say that the RfD is a chronic human equivalent dose concentration based on the observed No Adverse Effect Level (NOAEL) in animal dose response toxicological studies.

41. Section 4.1, pg. 4-1, para. 3: The inclusion of radionuclides in the final sentence is misleading. In general, radionuclides are important in toxicology because of their carcinogenicity and as such are unlikely to have reference doses. The authors should therefore omit the word radionuclides from this sentence.

42. Section 4.1, pg. 4-2, para. 1: The final sentence gives a misleading picture of the mechanism of induction of systemic toxicity and should be deleted. Many of the systemic responses which might qualify for consideration as a toxicological endpoint are not necessarily associated with cell depletion or cell death. For example, comparative elevation of plasma cholesterol in test versus control animals would be a toxic response reflective of the interaction of a number of subtle physiological and biochemical changes.

43. Section 4.2, entire section: the explanation should be shortened. It is sufficient to make the key point that the animal NOAEL is factored with a number of uncertainty factors which yield a human equivalent RfD which is conservative.

44. Section 4.3, pg. 4-5, Table 4-1: The inclusion of the uncertainty factors in this table SHOULD be re-evaluated. They are used to calculate the RfDs, and consequently their presence in this table is somewhat misleading.

45. Section 4.3, pg. 4-6, para. 3: The final three sentences of this paragraph should be deleted they are almost identical to the second paragraph on this page.

46. Section 4.3, pg. 4-6, para. 5: The consideration of the EPA classification of categories of carcinogens appears to be irrelevant to the concept of uncertainty. Please evaluate this material.

47. Section 4.4, pg. 4-7, whole section: The need for all the descriptive toxicological summaries given in this section should be evaluated. It should be sufficient to give the reference doses and slope factors. The key point is to make sure that these parameters are correct. Thus, in Table 4-2, the oral slope factor for methylene chloride should read "7.3E-03". Also, the units for the inhalation slope factor are incorrect. These should be $(mg.kg^{-1}.day^{-1})^{-1}$. As a further general point it , is recommended that all the values for reference doses and slope factors given in this section be verified.

48. Section 4.4, pg. 4-8, Table 4-2: Footnote (c) is incorrect and contrary to statements and values given elsewhere in the document. Section 7.3.3 of RAGS, Volume I (Part A) EPA/540/1-89/002, states that slope factors for category C carcinogens are derived on a case-by-case basis.

49. Section 4.4, pg. 4-11, para. 4: In the final sentence of this paragraph it is written, that the uncertainty factor is necessary to transform the RfD in some way. It has been used to calculate the RfD.

50. Section 4.4, pg. 4-12, para. 1: A cancer slope factor should be established as a health protective standard. It is more true to say that the slope factor is an index of extra unit risk, and can thus be used to define doses and concentrations which are equivalent to predetermined levels of extra risk.

51. Section 5.3, pg. 5-7, para. 1: Please evaluate this discussion. Much of the material in this paragraph is repetitive and should be deleted. The final sentence puts the wrong emphasis on the weight-of-evidence classification. The reference to the weight-of-evidence category does not reflect uncertainty in the context (numerical) that it is used in the rest of this account.

52. Section 5.3, pg. 5-7, para. 2: The final sentence about the ability to compare carcinogenic and non-carcinogenic slope factors is extremely confusing and should be deleted. It is recommended that the acronym " Appendix ORNL" be defined and its relation to this matter be explained.

53. Section 5.4, pg. 5-7, para. 1: The final sentence in this paragraph is an overly compressed account of some of the most important material in the whole risk assessment section. It is vital that inputs for a subset of key scenarios, perhaps the seven listed in Table 5-2 be highlighted, and that it be demonstrated step by step precisely how results are derived. At the present time, it is not clear to the reviewers (1) how the concentrations listed in Table 5-4 were derived, (2) where the apparently incorrect slope factors came from, or (3) what relationship the concentration values in Table 5-4 have to those listed in earlier evaluation concentration listings (e.g., Tables 3-11, or 2-3 to 2-6). Result summaries such as those in Table 1 of Attachment F6 can be taken as read if there is sufficient assurance through a subset of demonstration calculations within the text that the overall approach is sound. For simplicity, perhaps such demonstration calculations could be presented in tabular form.

54. Section 5.5, pg. 5-8, para. 1: The first sentence should refer to Tables 5-2 through 5-5.

55. Section 5.5, pg. 5-8, para.2: The first and second sentences should refer to Table 5-2.

56. Section 5.5, pg. 5-8, whole section: Section 8 of RAGS (Part A) advises against carrying out a quantitative uncertainty analysis unless there is an overwhelming justification. The reasoning for such an analysis of the data should be explained.

57. Section 5.5, pg. 5-9, Table 5-2: The second column of this table should refer to a scenario rather than a pathway.

58. Section 5.5, pg. 5-17, para. 1: In this section Table 5-4 is referred to as Table 5-3, and Table 5-5 is referred to as Table 5-4.

59. Section 5.5, pg. 5-18, Table 5-4: The justification for the use of different slope factors to those found in IRIS should be explained. It should also justify the use of 1.4 (presumably m^3/h) for the inhalation rate in pathways 4 through 7. It is also unclear as to what the concentration units are. In general, there should be enough detail to allow for computations to be independently reproduced. This is a very necessary element of quality control which needs to be carried out at source, as well as in the review phase.

60. Section 6.3, whole section including Tables 6-1 and 6-2: To give assurance that these determinations are based on correct assumptions, and have used the occurrence data in a scientifically valid manner, this section needs to be expanded to demonstrate, using a step by step approach, and the integrity of their determinations.As with the data presented in 5-2, there is no clear indication of how the calculated risk values presented in Tables 6-1 and 6-2 and within the body of the text were derived. Tables 1 and 2 of Attachment 6 do not shed further light on this matter either, but merely give a summary of a wider spectrum of information.

61. Section 6.4, pg. 6-8, para. 3: Please provide more detailed justification for the statement that the cancer incidence in the United States not associated with the site is 0.33, and include "Harrison 1987" in the reference list. The passage appears to imply that one in three citizens of the USA contract cancer, which is very hard to believe. Also please change 0.33001 to 0.33004 in this and other places where this mistake occurs.

62. Section 7, entire section: This section should be revised. The section appears to be little more than an abbreviated version of the whole of the first six chapters of volume 17. The only unique material appears to be the summary of exposure assessment results contained in Table 7-6. Once again, a key omission from this risk assessment is an adequate step by step demonstration of how these dose concentrations were obtained from whatever transformations of the evaluation concentrations which were used, and the standard or best estimate physiological parameters.

63. Appendix F-7, whole section: In contradiction of the table of contents, this section appears to be a reviewer checklist.

64. Appendix F, pg. 7-30, Table 7-8: The unit, mg/m^3, for inhalation SF should be $(mg/kg/day)^{-1}$.

APPENDIX A1 - BOREHOLE DATA

SPECIFIC COMMENTS:

65. Section A1.1.2, p. A1-3 thru A1-5: The discussion on these pages mixes the description of sampling intervals with sampling methods and sample handling. The text would be much easier to follow if these aspects were described separately.

66. Section A1.1.2, p. A1-5, paragraph 1: Methods for geotechnical analyses should be specified. Detailed discussion of geotechnical sampling may be more appropriate in Appendix A2.

67. Section A1.1.2, p. A1-6, paragraph 3: The Quality Assurance/Quality Control (QA/QC) section is superficial and raises many questions; e.g. were ambient blanks taken, and why were duplicates only analyzed for Semi-volatile Organic Compounds (SVOCs)? There needs to be at least a reference to the full QA/QC discussion that, presumably, is in another section of the report.

68. Section A1.1.2, p. A1-7, paragraph 3: Effluent and drum sampling are alluded to here. A more detailed description of sampling methods or a reference to a more appropriate section are needed.

69. Tables A1-1 and A1-2: Specific analytical methods should be specified on these tables.

APPENDIX A4 - FRENCH DRAIN GEOLOGIC CHARACTERIZATION

70. Section A.4.2.1.3, p. A4-8, paragraph 2: It would be appropriate to explain why a No. 230 sieve was used instead of the standard No. 200 for coarse/fine boundary definition of particle sizes.

71. Section A4.2.3.1.2, p. A4-13, paragraph 3: Concerning the potential crown cracks that were unnoticed prior to construction, it is unclear if the statement should read ".... prior to construction possibly due to vegetative cover that existed at the time of the field construction. The crown cracks may have developed during construction and may not have been present earlier."

72. Section A4.2.4.1, p. A4-17, paragraph 3: The question of how much water these units produce or what the rate of flow from these units was on average should be addressed. Some idea of the rate of flow would establish a relative benchmark for the reader.

73. Section A4.2.4.1, page A4-18, paragraph 1: It is suggested that a discussion of any evidence or possibility of perched groundwater within the curved slump basin above the surface of rupture, and its effect on the slope stability of the slump should be incorporated into the text.